IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:		))	Atty. Docket: 16600.105006
	Whitlock et al.	))	Art Unit: 3629
Application No.:	09/778,220	))	Examiner: Jamisue A. Webb
Filing Date:	February 6, 2001	))	Confirmation No.: 5736
Title:	**Method and System For Transferring Connecting Baggage**	)))	

DECLARATION OF IRINA IOACHIM

Commissioner for Patents
Washington, DC 20231

Dear Sir:

I, Irina Ioachim, residing at 120 Grantham Way, Tyrone, GA, 30290, and being duly warned, hereby declare and say:

1. I am submitting this declaration in response to the Official Action that was mailed on September 22, 2005 in connection with the above-identified patent application, and to establish the following:

   (A) the combination of the technical specification and drawing set for the present patent application discloses a representative "working" example of how to support an efficient transfer of items, such as baggage, from an inbound flight to one or more outbound flights;

   (B) and one of ordinary skill in the art in the fields of Industrial Engineering and Operations Research would be able to read the present application and make and/or use the invention defined by Claims 1-25 of the present application, without undue experimentation.

Background on Declarant/Inventor

2. I certify that my educational background includes the following:

- January 1991 – January 1995: Ph.D., Ecole Polytechnique de Montreal, Department of Mathematics and Industrial Engineering; Orientation – Operations Research; Quebec, Canada
- September 1988 – December 1990: M.S., Ecole Polytechnique de Montreal, Department of Applied Mathematics; Orientation – Operations Research; Quebec, Canada.
- September 1982 – September 1986: B.S., University of Bucharest, Faculty of Mathematics; Orientation – Pure Mathematics; Bucharest, Romania.

3. I certify that I have previously held the following positions of employment relating to Operations Research:

- January 2004 - April 2005: Business Consultant - Delta Technology Inc., Schedule Systems Department; Atlanta, Georgia
- March 1998 – December 2003: Manager - Operations Systems Group; Delta Technology Inc., Operations Research Department; Atlanta, Georgia.
- September 1997 – February 1998: Senior Developer; Delta Technology, Operations Research Department; Atlanta, Georgia.
- September 1994 – September 1997: Assistant Professor; Laval University; Faculty of Management Science, Department of Operations and Decision Systems; Quebec, Canada.

4. I certify that I am currently employed as a General Manager for Delta Air Lines for Network Planning Systems and Distribution in Atlanta, Georgia, and have held this position since February 1, 2006.

5. I certify that I am one of the co-inventors of U.S. Application No. 09/778,220, entitled "Method and System for Transferring Connecting Baggage," filed on February 6, 2001.

6. I certify that the subject matter of the above referenced application is related to the technical fields of Industrial Engineering and Operations Research.

7. I consider myself to be one of ordinary skill in the technical fields of Industrial Engineering and Operations Research. I am making this Declaration as one of ordinary skill in the art for those fields.

The Present Application Presents an Enabling Disclosure for the Invention of Claims 1-25

8. I understand that the Examiner has alleged that the present application fails to include a working example of how to determine assignments and calculate assignments and routes according to the variables claimed in the application. I further understand that the Examiner has alleged that one of ordinary skill in the art would not be able to read the present application and determine how to calculate potential assignments and routes and determine the best assignment and route, without undue experimentation.

9. I certify that I have reviewed the present application in preparation of this Declaration, which includes portions of the specification and corresponding figures disclosing subject matter relevant to calculating potential assignments and routes and selecting an efficient assignment and route.

10. As one of ordinary skill in the art, I certify that the disclosure of the present application, with particular reference to page 7, lines 26 to page 11, line 12 and Figures 5, 6 and 10, presents an enabling disclosure sufficient for one of ordinary skill in the art in the fields of Industrial Engineering and Operations Research to achieve a calculation of a plurality of costs of potential assignments and a selection of an efficient assignment, as recited by independent Claims 1 and 20, without undue experimentation. In particular, the equation at page 8, lines 5-11, the variables called "weighting factors," as defined by page 8, lines 13-23 (driver cost, bag cost, stop cost, and balance cost), the disclosure of page 8, line 24 to page 9, line-26, and the illustrations of Figures 5, 6, and 10 provide technical disclosure of sufficient scope to enable one of ordinary skill in the art to complete the

recited calculation or formulation of a plurality of costs of potential assignments and a selection of an efficient assignment.

11. The disclosure of page 9, lines 3-26 and the illustration of Figure 6 provides a representative "working" example of a calculation of a plurality of costs of potential assignments and a selection of an efficient assignment. For example, Figure 6 presents representative assignment solution combinations for the disclosed assignment example defined by delivering the sample number of bags to a sample number of stops for five airport zones (TGT, ASE, ANE, ANO, ASO). Figure 6 also identifies numerical values for variables used in the cost equation identified by Page 8, lines 5-11, including Max bags, Max stops, Target bags, Target stops, Driver cost, Bag cost, Stop cost, Balance cost, and a Pair cost. Furthermore, the cost equation identified by Page 8, lines 5-11, can be rewritten with variables as disclosed on page 11, lines 4-10.

12. To assist in explaining the representative "working" example of a calculation of a plurality of potential assignment solutions and the selection of an efficient assignment solution disclosed on page 9, lines 3-26 and in the illustration of Figure 6, the following explanation of the software module's calculation of a cost of a potential assignment solution is provided here in reference to the cost equation identified on page 11, lines 4-10. First, a discussion of the variables of the cost equation and how the variables are calculated will be provided. The cost equation identified on page 11, lines 4-10 is defined as follows:

Cost =

B = (number of drivers)*(driver cost) +

C = (max(num. bags) - min(num. bags))* (balance cost) +

D = (num. same side zones not kept together)*(pair cost) +

E = ∑assignments (max (num. bags, target num. bags)-(target num. bags))**2*(bag cost) +

F = (target num. of bags - min(num.bags, target num. of bags))*(bag cost) +

G = (max(target num. of stops, num. of stops) - target num. of stops)*(stop cost)

For each variable in the cost formula, the numerical values presented in Figure 6 will be utilized. Variable B represents the total cost incurred by assigning a given number of drivers. Variable B is calculated by multiplying the total number of drivers times a fixed unit cost. A fixed unit cost is used per driver, set at 10,000, as defined in Figure 6. Therefore, for each additional driver added to an assignment, the total cost will increase 10,000. For instance, using two drivers to cover the optimal assignments results in a 20,000 value for variable B, three results in a value of 30,000 and so on.

Variable C is defined by the difference between the maximum number of bags and minimum number of bags multiplied by a balance cost. For example, with three driver assignments as follows: (1) TGT with 15 bags and 3 stops and (2) ASE and ANE with 20 bags and 8 stops (the sum of ASE and ANE as defined in Fig. 6), and (3) ASO and ANO with 22 bags and 7 stops (the sum of ASO and ANO as defined in Fig. 6). The value of variable C for these three driver assignments is calculated as [max(15, 20, 22) - min(15, 20, 22)]*(balance cost). Therefore, [22-15]*100 = 700.

One of ordinary skill in the art will recognize that Variable C does not have to be included in the formulation of the cost equation until all potential zones are incorporated into the assignment solution. The reasoning for this is because the determination of Variable C includes the difference between the maximum number of bags and minimum number of bags in the assignment solution; therefore, without all of the potential zones included, the value of the maximum and minimum number of bags for the assignment solution cannot be determined. Therefore, in the costs formulations associated with Figure 6, the cost values represented only include the calculation of Variable C when the potential assignment solution comprises the TGT, ASE, ANE, ANO, and ASO zones.

Variable D is defined by number of same side zones of a concourse not kept together multiplied by a pair cost. For the representative working example of Figure 6, the airport configuration is represented in Figure 4. The pair cost for splitting the odd or even zones for each concourse is set to 700, as defined in Figure 6. The three driver assignments used above (i.e. (1) TGT 15 bags and 3 stops and (2) ASE and ANE 20 bags and 8 stops,

and (3) ASO and ANO 22 bags and 7 stops result in an overall pair cost of zero, as no splitting occurs. However, in an example with a four driver assignment as follows: (1) TGT 15 bags and 3 stops and (2) ASE and ANE 20 bags and 8 stops, (3) ASO 12 bags and 2 stops, (4) ANO 10 bags and 5 stops; the resulting value of variable D is 700, as one split would occur on the odd side of concourse A because ASO and ANO are split between separate assignments 3 and 4.

Variable E measures the difference of how many bags a given driver assignment has over the target number of bags, squaring this value, and then multiplying by the unit bag cost of 25, as defined in Figure 6. For example, a driver assignment for TGT with 15 bags and 3 stops has 10 less bags than the target number of bags which is defined in Figure 6 as 25. Therefore, the value of variable E will be computed as follows: [max(15,25) - 25)**2]*25 = 0. In another example, a hypothetical driver assignment for ASE, ANE and ANO which has 30 bags and 13 stops, results in the value of [max(30, 25) - 25)**2]*25 = [5**2]*25 = 625. Note that, in the context of the example depicted in Figure 6, this hypothetical assignment of ASE, ANE, and ANO is not valid as it covers 13 stops, which exceeds the maximum number of stops defined in Figure 6 as 10. This hypothetical is used only for the purpose of illustrating the calculations for variable E.

One of ordinary skill in the art will recognize that Variable E does not have to be included in the formulation of the cost equation until all potential zones are incorporated into the assignment solution. The reasoning for this is because the determination of Variable E includes determining the maximum number of bags in the assignment solution; therefore, without all of the potential zones included, the value of the maximum number of bags for the assignment solution cannot be determined. Therefore, in the costs formulations associated with Figure 6, the cost values represented only include the calculation of Variable E when the potential assignment solution comprises the TGT, ASE, ANE, ANO, and ASO zones.

Variable F helps measure the difference of how many bags a given driver assignment has under the target number of bags and then multiplies that value by the unit bag cost. Using the previous example discussed above, a driver assignment for TGT with 15 bags and 3 stops which has 10 less bags than the target number of bags, the value of variable F is calculated to be [25-min(15,25)]*25 = 250. Furthermore, for the hypothetical assignment considered above of ASE, ANE and ANO with 30 bags and 13 stops, the variable F will be calculated as [25-min(30,25)]*25 = 0.

One of ordinary skill in the art will recognize that Variable F does not have to be included in the formulation of the cost equation until all potential zones are incorporated into the assignment solution. The reasoning for this is because the determination of Variable F includes determining the minimum number of bags in the assignment solution; therefore, without all of the potential zones included, the value of the minimum number of bags for the assignment solution cannot be determined. Therefore, in the costs formulations associated with Figure 6, the cost values represented only include the calculation of Variable F when the potential assignment solution comprises the TGT, ASE, ANE, ANO, and ASO zones.

Finally, Variable G measures the difference between the actual number of stops in an assignment solution and the target number of stops, and multiplies this value times a stop cost, as defined in Figure 6. Therefore, no cost is incurred whenever the number of stops is less than the target number. A stop cost of 150 is associated with each stop in excess of the target value. For example, a driver assignment of ASE and ANE with 20 bags and 8 stops will result in a value of [max(6, 8)-6]*150 = 300 for variable G.

13. Next, the following explanation of the calculation of one potential assignment solution represented in Figure 6 is provided. More specifically, I will discuss the calculations the EDS software module processes to produce the branch represented in Figure 6 that ends with a total assignment cost of 33,750 and is discussed on page 9, lines 6-20 in connection with the formula discussed above.

The diagram begins at the TGT zone and at that point has 15 bags and 3 stops. At this point, the assignment cost has a value of 10,000. The assignment cost is calculated at this point as follows:

Cost =

B = (1)*(10,000) = **10,000** +

D = (0)*(700) = **0** +

G = (max(6, 3) - 6)*(150) = **0**

Therefore, the total assignment cost is equal to B(10,000) − D(0) + G(0) = 10,000 as represented in Figure 6 by "TGT 15,3 10000."

Next, taking the left branch, the ASE zone with 10 bags and 4 stops is added to the assignment solution with the TGT zone yielding a total of 25 bags and 7 stops for a total assignment cost of 10,150. The total assignment cost is calculated as follows:

Cost =

B = (1)*(10,000) = **10,000** +

D = (0)*(700) = **0** +

G = (max(6, 7) - 6)*(150) = **150**

Therefore, the total assignment cost is equal to B(10,000) + D(0) + G(150) = 10,150 as represented in Figure 6 by "ASE 25,7 10150."

Next, the diagram continues to the left to attempt to add either of the adjacent zones, ASO or ANE, to the TGT/ASE assignment solution. However, the addition of either zone, ASO or ANE, to the assignment solution results in total baggage counts of 37 and 35, respectively. Therefore, because the maximum number of bags is set at 30, as defined in Figure 6, the assignment algorithm does not add the ASO or ANE zones.

Instead, the algorithm takes the right branch after the point the ASE zone was added to the TGT zone to begin a new assignment. Once again the algorithm will choose between adding one of the adjacent zones, ANE or ASO, in a new assignment. The algorithm will first move to the left branch and begin a new assignment with the ANE zone. The totals for bags and stops used at this calculation are the TGT/ASE zones which has 25 bags and 7 stops and the ANE zone which has 10 bags and 4 stops. After the calculation, the total assignment cost for this solution is 20,850. This calculation is determined as follows:

Cost =

B = (2)*(10,000) = **20,000** +

D = (1)*(700) = **700** +

G = [(max(6, 7) - 6)*(150) = 150) + (max(6, 4) - 6)*(150) = 0)] = 150

At this point, the number of same side zones not kept together is equal to one because, as represented in the representative airport configuration of Figure 4, the new zone, ANE, is being separated from its same side zone, ASE, which was paired with TGT above in this particular assignment solution. Therefore, the total assignment cost for the assignment of the TGT/ASE zones and ANE zone is B(20,000) + D(700) + G(150) = 20,850 which is represented in Figure 6 by "ANE 10,4 20,850."

Next, continuing to the left branch, the algorithm adds the ANO zone to the ANE zone for this particular assignment solution which produces an assignment with 20 bags and 9 stops, which is calculated by adding the ANE zone of 10 bags and 4 stops with the ANO zone of 10 bags and 5 stops. This value will be used along with the TGT/ASE assignment which has 25 bags and 7 stops combined. The assignment cost algorithm returns a total cost value of 21,300 as calculated below:

Cost =

B = (2)*(10,000) = **20,000** +

D = (1)*(700) = **700** +

G = [(max(6, 9) - 6)*(150) = 450) + (max(6, 7) - 6)*(150) = 150) = 600

Therefore, the total assignment cost is equal to B(20,000) + D(700) + G(600) = 21,300 which is represented in Figure 6 by "ANO 20,9 21,300."

Finally, moving to the next left branch and attempting to add the final zone, ASO, to the ANE and ANO zones yields 32 total bags which violates the maximum of 30 bags as defined in Figure 6. Therefore, in order to add the final zone, ASO, a new assignment with only the ASO zone must be created with 12 bags and 2 stops. The addition of an assignment with just the ASO zone produces an assignment solution of three assignments, wherein the first assignment comprises the TGT and ASE zones (25 bags, 7 stops); the second assignment comprises the ANE and ANO zones (20 bags, 9 stops); and the third assignment comprises the ASO zone (12 bags, 2 stops). The total cost for this assignment solution is 33,750 and is calculated as below.

Cost =

B = (3)*(10,000) = **30,000** +

C = (max(25,20,12) - min(25,20,12))* (100) = **1300** +

D = (2)*(700) = **1400** +

E = ∑assignments [(max (25, 25) - 25)**2*(25) = 0) + (max (20, 25) - 25)**2*(25) = 0) + (max (12, 25) - 25)**2*(25) = 0)] = **0**

F = [(25 - min(25, 25))*(25) = 0) + (25 - min(20, 25))*(25) = 125) + (25 - min(12, 25))*(25) = 325)] = **450**

G = [(max(6, 2) - 6)*(150) = 0) + (max(6, 9) - 6)*(150) = 450) + (max(6, 7) - 6)*(150) = 150)] = **600**

At this point, all five zones (TGT, ASE, ANE, ASO, and ANO) are included in the potential assignment solution; therefore, Variables C, E, and F are included to the cost equation. The total assignment cost is equal to B(30,000) + C(1300) + D(1400) + E(0) + F(450) + G(600) = 33,750 which is represented in Figure 6 by "ASO 12,2 33,750."

Therefore, at the end of this branch, one potential assignment solution has been completed which encompasses all five zones for a total cost of 33,750. Next, the EDS software module proceeds with all the remaining combinations of assignment solutions zones as set forth in Figure 6. For each assignment solution, the cost is calculated as described above.

As represented in Figure 6, certain branches of the assignment solutions are cut short by a solid black line. The solid black line indicates that the branch has exceeded either one of the max bags or max stops values defined by Figure 6 or the total cost of that particular assignment solution has exceeded the total cost for a complete assignment solution that has already been calculated. For example, subsequent costs of assignments solutions that exceed the cost of the assignment solution calculated above at 33,750 will be eliminated by the EDS software module because it would not be most efficient solution.

After calculating the cost of all of the combinations of assignment solutions, the most efficient assignment solution is identified by choosing the assignment solution with the lowest assignment solution cost. As represented in Figure 6, the most efficient assignment solution is the solution with three assignments of: (1) TGT zone, (2) ASE and ANE zone, and (3) ANO and ASO zone, which has a total assignment solution cost of 31,500. This assignment solution will be used by the EDS software module to determine the most efficient routing solution to carry out the most efficient routing solution.

14. As one of ordinary skill in the art, I certify that the disclosure of the present application, with particular reference to page 11, lines 12 to page 12, line 11 and Figures 7 and 8, presents an enabling disclosure sufficient for one of ordinary skill in the art in the fields of Industrial Engineering and Operations Research to achieve a calculation of a plurality of potential routes and a selection of an efficient route, as recited by independent Claims 1 and 20, without undue experimentation. In particular, Figure 7 and the corresponding discussion at page 11, lines 12-30, provide a technical disclosure of sufficient scope to enable one of ordinary skill in the art to complete the recited formulation of a plurality of potential routes and a selection of an efficient route. Further, one of ordinary skill in the

art will understand that the formulation of the plurality of potential routes will vary depending on how different airports are configured, and that the discussion in the present application relates to a representative airport configuration as illustrated in Figure 4.

15. The disclosure of page 11, line 12 to page 12, line 11 and the illustration of Figures 7 and 8 provide a representative "working" example of a formulation of a plurality of potential route and a selection of an efficient route. For example, Figure 8 presents representative route combinations and identifies numerical values for total distances calculated between stops in a routing solution defined in Figure 8.

More specifically, Figure 8 illustrates Step 725 of Figure 7 where the routing algorithm creates different combinations of routes. In the representative example of Figure 8, the routing solution must determine the most efficient route solution from an assignment solution that has nine stops comprising 3 stops at the T gates, 4 stops on the even side of the A gates, and 2 stops on the odd side of the A gates.

The process of formulating a routing solution begins with identifying whether any close connecting flights exists in the assignment solution. Close connection flights are typically defined as any flights leaving within a half hour of the arrival of the inbound flight. If any close connecting flights exist in the assignment solution, the routing solution prioritizes these flights in order of earliest departure time. The close connecting flight that departs last then becomes the starting point for all remaining connections in the assignment solution. In the representative example of Figure 8, the routing algorithm has determined that there are no close connecting flights in the assignment solution and has set the starting point for the routing solution at Gate A10, the inbound flight gate.

Similar to assignment solution discussed above, the routing algorithm prepares a branch diagram of all possible combinations of routes to satisfy the assignment solution. Next, the routing algorithm conducts the total distance for each potential routing solution. Therefore, in Figure 8, the routing algorithm first calculates the total distance from gate A10 to the other even A gates in the following order: A26, A6, and A2. The total

distance is calculated by summing the distances between each gate using the gate coordinates defined in Figure 8. One of ordinary skill in the art will understand that the coordinates of gates used in Figure 8 are merely representative of an sample airport configuration as illustrated in Figure 4.

One of ordinary skill in the art will further understand that calculating the distance between gates with a corresponding coordinate (X, Y) value involves basic geometry calculations. However, as an example, the total distance between gates A10, A26, A6, and A2, as represented by the first left branch in Figure 8, is calculated as follows:

Start: Gate A10 (40, 100000); 1st Destination: Gate A26 (1030, 100000)

- Since both gates have the same Y-coordinate value the first distance is the difference between X-coordinates, 40 and 1030, or **990**.

Start: Gate A26 (1030, 100000); 2nd Destination: Gate A6 (20, 100000)

- Once again, since both gates have the same Y-coordinate value the second distance is the difference between X-coordinates, 1030 and 20, or **1010**.

Start: Gate A6 (20, 100000); 3rd Destination: Gate A2 (0, 100000)

- Finally, since both gates have the same Y-coordinate value the third distance is the difference between X-coordinates, 20 and 0, or **20**.

Therefore, the total distance between gates A10, A26, A6, and A2 is 990 + 1010 + 20 = **2020**, which is represented in Figure 8.

Similar to the assignment algorithm discussed above, the routing algorithm continues to move from left to right in the branch diagram calculating the total distances between each gate in the assignment solution. At the bottom of the left branch of Figure 8 is the first potential routing solution calculated by the routing algorithm to satisfy the assignment solution. This particular routing solution defines the routing order as A10-A26-A6-A2-T4-T5-T6-A3-A31 with a total distance of approximately 213090. Subsequently, as the routing algorithm calculates total distances for additional routing solutions, the routing algorithm will ignore further solutions that have a higher total distance than a previously

calculated routing solution. This is represented in Figure 8 with a solid black line through a branch.

As discussed above, the routing algorithm continues to calculate the total distance for each routing solution until all routing solutions have been calculated. At this time, the routing algorithm selects the routing solution with the lowest total distance as the most efficient routing solution for delivering the bags of the most efficient assignment solution. In Figure 8, the most efficient routing solution is represented by the second to last node of the branch diagram on the bottom right side of Figure 8. This particular routing solution defines the routing order as A10-A6-A2-A26-A31-A3-T4-T5-T6 with a total distance of approximately 122140.

16. I further declare that my statements made herein of my own knowledge are true, and that all statements made on the information and belief are believed to be true; and further that these statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements and the like so made may jeopardize the validity of this declaration, the subject application or any patent issuing thereon.

Respectfully submitted,

I Ioachim

Irina Ioachim

22 February 2006

Date